Attorney Docket No. 83303 24 February 2006

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: THOMAS RAMOTOWSKI
Serial No.: 10/719,852
Filed: 21 November 2003
For: HIGH STRAIN PIEZO-POLYMER

Group Art Unit: 1713
Examiner: Henry S. Hu

DECLARATION UNDER 37 CFR 1.132

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sirs:

In response to the Office Action of December 2, 2005, please enter this Declaration in support of the Amendment submitted herewith.

I hereby declare:

What is the invention of the present application? The invention is a new and novel way to make a high-strain, electrostrictive polymer in the PVDF-TrFE family of polymers.

What was the situation prior to this discovery? High strain electrostriction in the PVDF-TrFE family of polymer is known in the art by discovery at Penn State University. By high strain, this means strains of 4% to 5%. Prior to this discovery, this family of polymers was not known to exhibit high

electrostrictive strains. Certain formulations were known to exhibit modest piezoelectric strains (ca. 0.3% to 0.4%).

How does the initial discovery differ from the invention? PVDF-TrFE was initially converted to a high-strain electrostrictor via large doses of high-energy beta radiation. The invention of the present application describes a way to achieve the same effect solely by chemical synthesis. The "right" polymer can be synthesized from the start and the radiation processing step can be avoided. This synthesizing without a radiation processing step provides a resultant electrostrictive material of a significant, practical advantage.

What are the advantages of the invention over the pre-existing method? The beta radiation treatment of the pre-existing method is slow and expensive (it takes time to build up the required high doses). The treatment also limits the size of the finished pieces (the width of the radiation beam is limited). In addition, the polymer must be processed in a special laboratory - the material cannot be applied and processed in the field or *in situ*. Finally, the radiation damages the polymer in ways that are not desirable - but there is no way to avoid this damage and convert the PVDF-TrFE into a high strain electrostrictor.

The invention of the present application produces a polymer that is high strain electrostrictor without any additional processing steps. No radiation or stretching is required. Once the film is cast, annealed, and electroded, it is ready for use. Thus, the size and shape of the final film are not restricted, the polymer could be applied to a surface in situ or in the field, and the polymer itself is not damaged or compromised in any way (unlike the results of the radiation treatment).

Is the invention "obvious" to one skilled in the art? Absolutely not. The differences between the claimed invention and the prior art indicated in the Office Action differ to an extent that the difference is really unexpected and that results achieved under the present invention are a marked improvement over results achieved under other ratios , as to be classified as a difference in kind, rather than one of degree. How the beta radiation converts PVDF-TrFE into a high-strain electrostrictor is not understood without extensive experimentation. The high energy particles cause a number of chemical and physical changes in the polymer, only a few of which were "beneficial" from the perspective of creating a high-strain electrostrictor. All of these changes have to be identified and examined for their effect on high-strain electrostriction in the polymer, using a variety of state-of-

the-art polymer analysis techniques (FTIR, thermal analysis, fluorine-19 NMR, etc.).

Once it is understood how beta radiation changes PVDF-TrFE into a high-strain electrostrictor, a method for producing the same changes strictly through chemical means needs to be devised. This approach suggests that certain monomers should produce the desired effect. The end result is the modification of PVDF-TrFE from a copolymer to a terpolymer of the form PVDF-TrFE-X, where "X" is a small amount of a third monomer that makes the resulting terpolymer a high-strain electrostrictor.

What is "new" or "novel" about the invention?

a. The conversion of PVDF-TrFE into a high-strain electrostrictor solely via chemical means (conversion to a terpolymer with the proper PVDF/TrFE/X ratios for high-strain electrostriction).

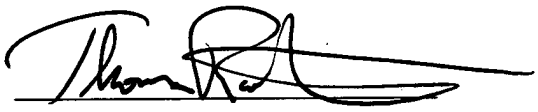
b. The "selection rules" for the third monomer, "X", that converts PVDF-TrFE into a high-strain electrostrictive terpolymer, while maintaining other desired properties (percent crystallinity, reasonable coercive fields, moderate coupling factor).

c. The fact that the resulting terpolymer is stable and does not exhibit any operational hysteresis (i.e., the high strain electrostriction is inherent to the structure of the terpolymer and is not an occurrence created by injected charges, or a meta-stable physical state that changes over time.

In response to the Office Action of December 2, 2005, I hereby declare that the arguments presented are supportable by laboratory results acceptable in the pertinent field of art and those arguments reflect the remarks of the amendment attached herewith such that rejections of the present and previous Patent Office actions identified with the present application are traversed.

I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 USC 1001 and that such willful false statements may jeopardize the validity if the application or any patent issued therefrom.

Respectfully submitted,
THOMAS RAMOTOWSKI



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